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1. Visibility and Camouflage in Warfare

For several months the section on colorimetry has been engaged on problems relating to visibility and camouflage, including particularly (1) the examination of light filters designed to improve the visibility of objects under observation; and the design and preparation of such filters; and (2) the determination of the spectral reflection of materials. A method for color grading of red signal flares has been developed and reported upon.

Colorimetric work recently completed has included spectral transmission of 7 eye-protective goggles; spectral and diffuse reflecting power of 6 samples of painted canvas; spectral transmission of 1 sample of purple glass; determination of the visibility of certain green tape; spectral transmission of 1 pair of anti-camouflage goggles,- all of the above tests being conducted for some branch of the military service.

2. Protection of Moving Picture Film from Heat of Lamp

A moving picture film is partly protected from the intense heat of the lamp by the great speed with which it moves across the luminous field. In certain military work, however, it is desirable to stop the movement of the film in order to make an examination of the details in a single picture projected upon a screen.

Thin cathodic deposits of gold on glass have been used to (absorb) reflect these infra-red rays, but this is not quite satisfactory. Based on measurements made by the Bureau, it is suggested that plates of Corning "Heat absorbing" glass be used in addition to the water cell which is always employed in protection apparatus. A dilute solution of cupric chloride, ($\frac{1}{2}$ to 1 percent) used in this water cell will greatly reduce the infra-red rays. The slight change in color introduced by the solution should be beneficial in increasing the visual acuity.

3. Photo-electric Signalling Methods

Further experiments were carried out on the Bureau's device for dark signalling, using the radiations from the moon as a source of light and resulted in satisfactory transmission of signals even though the rays were passed through two sheets of glass which absorbed all the visible rays. The energy value of the beam was $3 \times 10^{-7}$ gram calories per second;--an amount of heat so small that it would require four days to raise the temperature of one gram of water 1°C. The minimum energy audibly perceptible would of course be considerably lower than this value.

4. Sound Ranging — The further improvements on the sound ranging apparatus have been successful and a complete new set together with new accessories for the sets already abroad, has been made up for transhipment to France. It is planned that two of the men who have been engaged in this work shall accompany the apparatus abroad.

5. Blasting Machines — At the request of the General Engineer Depot a study has been undertaken of the machines used in the firing of trench mortars, etc. Preliminary experiments on somewhat radical changes of design have been very promising and it seems wholly feasible to increase the efficiency greatly. The results, which have been transmitted to the branches of the service interested, are now being studied by the manufacturers from the point of view of production.

6. Inductance Coils for Radio telegraphy — A systematic study of this problem for cases in which low resistances are required is being undertaken, from which it is hoped to obtain data valuable to engineers in the design and selection of inductance coils for various types of service.

7. New Radio Laboratory — The building for the new joint Army, Navy and Bureau of Standards Radio Laboratory is now complete and the laboratory service and equipment are undergoing installation.

8. Insulating Materials for Radio Apparatus — Supplementary investigations and reports have been completed on the properties of the leading types of sheet insulating material in use for radio purposes, this following a report rendered to the Navy Department and to the Signal Corps at the end of April last.

9. Safety Standards — The Bureau is in active cooperation with the Working Conditions Service of the Department of Labor which is in charge of the study of working conditions and the establishment of safety standards in all industrial establishments operating on Government contracts.

10. Lighting Curtailment for Coal Saving — In this matter the Bureau has cooperated with the Conservation Bureau of the Fuel Administration and estimates have been prepared of the consumption of coal devoted to electric lighting and of the portion which might be saved by various measures of conservation, such as the elimination of display lighting, the substitution of tungsten for carbon filament lamps, and the reduction of the number of lamps used in fixtures carrying several lamps. Conferences have been held with various parties interested for the purpose of formulating instructions covering this phase of conservation.

11. Inspection and Life Tests of Electric Lamps

Lamps inspected during the past fiscal year included approximately 1,100,000 carbon filament and 2,600,000 tungsten filament lamps, while life tests were completed on 559 carbon and 2,015 tungsten lamps. While the percentage rejected on inspection at the best factories is low, there is absolutely no question that orders on which lamps are to be inspected receive special care and that lamps which fail on inspection go to fill orders not so inspected.

12. Army Searchlights

The work on field searchlights, carried on in cooperation with the General Engineer Depot, included an extensive series of measurements to determine the distributions of intensity in searchlight beams and a number of tests to determine the obstructive effect of the various types of front glasses.

13. Electric Trucks

At the request of the Construction Division of the War Department, the Bureau has been supervising an extensive test of electric trucks and tractors.

14. New Magnet Steel

There has been called to the attention of the Bureau a new kind of magnet steel showing an extraordinarily high residual magnetism. Efforts are being made to secure the information necessary to make it available for the use of the Government.

15. Proposed Substitute for Platinum

A sample dish of "Bario" metal (grade G) was tested and found to be wholly unsuited for chemical use as a substitute for platinum ware. The results of these tests show the falsity of certain advertising claims which have been made in behalf of the material.

16. Airplane Dope

A standard formula for acetate airplane dope was developed and accepted by the Navy Department. A study of methods for preparing ethyl lactate as a solvent for cellulose acetate was completed and a report will shortly be made to the Council of Defense.

17. Pneumatic Tires

On behalf of the War Department, extensive specifications covering pneumatic automobile tires were drawn up and finally submitted to the various manufacturers for criticism.

18. Soap

A large number of samples of various types of soap were examined for the Office of the Quartermaster General to the end of preparing specifications covering this class of material. These specifications are now available with respect to shaving soap, grit hand soap, and two grades of scouring soap. Work is now in progress on specifications for shaving cream.

19. Coatings for powder Containers

At the request of the Engineering Division of the Office of the Chief of Ordnance, samples of lacquers were examined with respect to their use as a coating for powder containers. After a study of the specifications the use of spar varnish on

the metal parts was recommended. Specifications were prepared for a material to serve as a seal around the crimped edges of the fiber container.

20. Electroplating Investigations

A great increase has been noted in the number of applications for the services of the Bureau's staff and facilities in the field of electroplating. One of the most urgent problems, namely, the application of lead plating, has been given considerable study and a circular, entitled "Preliminary Circular of Information on Lead Plating", has been prepared at the request of the Ordnance Department. The principal applications of lead plating are upon boosters and adapters used in gas shells and for increasing the weight of underweight shells. In the above circular recommendations are given for conditions of operation and methods of testing as well as tables showing the time required to deposit a given thickness or weight of lead and the area and quantity of lead required on the various boosters, adapters and shells.

The study of black nickel solutions and their application to hardware to produce the "government bronze" finish is still in progress. Some difficulty has been experienced in producing the desired finish with solutions less complicated than those now in use. Standardization of the requirements for this class of work is desirable. In this connection the Bureau is engaged, at the request of the Ordnance Department, in the consideration of various specifications for the finish of metal parts with a view to simplifying and systematizing the procedures used. Information has been received that certain zinc plated steel cartridge cases, plated at the Bureau, have yielded very good services and have withstood reswaging better than copper plated cases.

21. Electrotyping of Range Finder Scales

The reproductions of master range finder scales prepared by the Washington Electrotype Company by the use of wax moulds and mentioned briefly in an earlier issue of the Bulletin, have been measured and found to be amply accurate for the purpose. At the request of the New York Navy Yard, a representative of the Bureau made a trip of inspection for the purpose of investigating the methods available for reproduction of name and instruction plates of the type attached to naval guns, instruments, motors, etc.

22. Automatic Gas Analysis

Gratifying progress is noted in the investigation and design of apparatus for gas analysis, and instruments have been developed for the determination of hydrogen, carbon dioxide in large and

in very small amounts, ammonia in small amounts and water vapor in small amounts. While many of the mechanical details remain to be worked out they are not of a nature to cause serious difficulty. The application of an apparatus fulfilling the general function outlined above will be of the utmost value in the industries if successful practical outfits can be constructed.

23. Platinum and Platinum Substitutes

Analysis of platinum magneto contacts is being made for the Bureau of Aircraft Production. Some analytical work is being done on an alloy known as "Clebrium". Tests were made of 6 crucibles for the War Industries Board, 4 of Rhotanium, 1 of Palau, and 1 of Platinum. Base metal platinum substitutes submitted to preliminary tests have proved unsuitable.

24. Protective Coatings

At the instance of the Shipping Board a report was made covering the salt-spray tests of paints and metallic coatings for the reinforcing members of concrete ships. At the request of the Equipment Section of the Engineering Division, Ordnance Department, tests were made to show the relative value of German Silver and tin-coated steel hinges for meat cans. The tin-coated hinges were regarded as superior to German Silver but a zinc coating is believed to be superior to either. A test for pin-holes in lead plating has been developed, consisting of immersion of the samples in a solution which indicates the pin-holes by a characteristic blue precipitate.

25. Aeronautic Instruments

On account of the important effect of the vibration of the airplane produced by its power plant, on the accuracy and durability of the instruments carried, it has been deemed advisable to make a special study covering the frequency, amplitude and direction of vibration in airplanes. It is expected that definite specifications will be ultimately applied to the conduct of vibration tests. Studies are also under way of the elastic properties of instrument diaphragms in relation to heat and mechanical treatment; of the spinning top inclinometer with especial reference to the error produced by prolonged banking; and of liquids used for damping of instruments. Important tests were made on a group of instruments of Danish manufacture including 2 inclinometers, a compass, and a number of barometers and altigraphs.

Three new confidential circulars on Aeronautic Instruments have been issued recently, one on spinning top inclinometers, another giving a list of the instruments tested during the last 6 months, and a third describing the methods of test applying to airplane tachometers. Photographs, instru-

ments and information of other sorts have been supplied to representatives of the Bureaus of Aircraft Production and of Military Aeronautics for use in carrying on a course of instruction for aviators, with respect to the use and maintenance of instruments. A specially designed chamber for the testing of tachometers depending upon air viscosity, has been constructed to permit of operation under reduced pressure. This comprises the novel feature of a flexible shaft driving through a mercury manometer tube, thus permitting one end of the tube to be exposed to atmospheric pressure while at the other end is maintained a reduced pressure corresponding to any desired altitude up to 30,000 feet. In a certain aneroid barometer rusty indicator chains resulting from the substitution of steel for german silver were discovered. As a result of determinations made on these instruments, 5,000 altimeters which had previously been accepted by the Bureau of Aircraft Production were rejected by them. A sample Russian tachometer submitted by the National Advisory Committee for Aeronautics was found to be superior to the American product in several respects.

Representatives of the Aeronautic Instruments Section visited the headquarters of the Royal Air Force in Toronto for conference with aviation officials regarding the practical requirements of aeronautic instruments. The Section was fortunate in being presented by the Commanding Officer of that Station with a set of 14 aeronautic instruments of different types, including 2 bomb sights of British manufacture.

The Bureau has cooperated with the General Engineer Depot in preparing data to form a basis of specifications for surveying aneroids for the use of the American Forces in Italy.

26. Analysis of Sound

Construction of a simplified form of the phonodeik for recording noises produced by airplane and truck motors has been completed. This is to enable obtaining a rough idea of the effect of mufflers and other sources of sound. Studies are being made in acoustical properties of tubing used in airplane listening apparatus.

27. Lacquers for Protecting Tarnishable, Metallic Optical Surfaces.

The Bureau has, at the request of the War Department, carried on a study of the possible protection of mirror surfaces against tarnish, in range finders, periscopes, airplane cameras, searchlights, etc. Well enclosed mirrors, unlacquered, will not tarnish appreciably for a year or more and the tarnish which appears is soluble and easily removed. Experiments show that the reflecting power of a lacquered surface is considerably below that of an uncoated silver surface.

Investigation was made of the photochemical action of the ultra-violet light such as obtains in a searchlight, and definite conclusions regarding the best materials for such mirrors have been reached.

Respectfully,

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Director